REINDEER ANTLERS

A Guide for the Preparation and Storage of Uncalcified Male Antlers as a Medicinal Raw Material

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PREFACE

In translating this article from the Russian language and editing it for distribution, we decided to present the information in "working" English rather than in grammatically perfect English. This decision was made to save time and therefore, financial resources. References were not translated but will be furnished gratis (in Russian) upon request. The two figures in the original article are of such poor quality that we decided not to reproduce them for this translated version. Figure 1 is a photograph of dried antlers with and without skin (velvet) cover; Figure 2 shows a wood-fueled chamber for drying antlers. This device might be used in villages where electricity or heating oil is in short supply but it is unlikely that it would be used in our larger cities, e.g. Nome or Kotzebue, especially when large amounts of antler are to be preserved. Photocopies of these two figures can be furnished at cost.

It might be helpful to know, in advance of reading this article, that the following terms and definitions are used widely throughout the Soviet Union.

Panty(i) . . . . . velvet antler
Pantocrin(e) . . . medicinal preparation from the velvet antler of axis deer (Cervus nippon hortulorum)
Rantarin(e) . . . medicinal preparation from the velvet antler of reindeer (Rangifer tarandus sibericus, Flerov)

THE EDITORS

The History of the Study of Animal Antlers

At the first glance of one who is not initiated into the secrets of pharmacology, the aspiration of scholars to study animal antlers in detail seems strange. In ordinary life the antlers seem to be only a heavy, bony formation suitable (and not always) for simply decorative purposes. B. K. Bol' and L. N. Nikolaevsky carried out a detailed morphological histological study of reindeer antlers in 1936. They wrote: "it can be wisely said that no tissue, no regenerative organ in vertebrates has such a rapid growth as is observed in the regeneration of the antlers of the reindeer." During June the growth of antlers consists of one to two centimeters per day.

Craniological studies have attracted the attention of many authors. The special object of study were the antlers of various agricultural and wild animals. Of more than 20 species of artiodactyls living in the Soviet Union, only the musk deer does not have antlers on the skull.

Defense is not the main function of the antlers. Their development is subordinate to the processes of reproduction and conditions of the existence of the animals (32, 36, 76, 77, 80)*. In their growth the nervous system plays a definite role (106).

After studying the character of growth and the changes in the antlers of various animals (2, 85), specialists have successfully used cow (40, 41, 89) and sheep (39, 79) horns in osteoplastics as a means for osteosynthesis and substitution of bone defects. The keratin of animal antlers and hoofs facilitates the growth and development of fur-bearing animals (104, 107). It is maintained that the antlers may be turned into an easily assimilated feed for animals and birds (71, 86). An extract of ground antlers from large-horned cattle causes a significant increase in the quantity of leucocytes maintained for five hours and hyperplasia of the lymphatic tissues in experimental rabbits (88). In the literature there are references to the antlers of the saiga, an exportable medicinal raw material. Various authors (31) inform us that antlers which have flowing blood have the greatest medicinal potency. Contemporary pharmacological research points to the tranquilizing effect of preparations from the antlers of the saiga (8, 9, 10, 54).

Of particular importance in research are the uncalcified antlers of the axis deer (Cervus nippon hortulorum). These antlers have been a traditional commodity of Eastern medicine. In 1928 the famous specialist in reindeer husbandry, S. A. Gryuner, wrote of his lack of

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*Reference number; references provided upon request ... Editor.

faith in the medicinal potency of antlers. Nevertheless more than 1,150 years ago in Japan antler-bearing reindeer were considered holy and blessed. One of the authors of the present work (A. M. Yudin) observed in Nara, Japan the exceptional domestication of reindeer around a Buddist temple.

The extensive research of Soviet scholars has allowed the creation of pantocrin -- a preparation from the antlers of the axis deer which is widely used in the current practice of preventive health care (57), the perfection of the method of the preparation of the raw material (14, 15, 70, 91), and the discovery of new methods of preserving the biological activity of the antlers (6, 21, 23-26, 28). Recently an extensive bibliography has been compiled concerning the antlers of the axis deer (5, 7, 15, 22, 25, 29). The interested reader can find an abundant amount of information.

In recent times information has appeared concerning the presence of biologically active substances in the antlers of elk (13, 81) and European deer (105). In the literature there are notations (65) on the biological activity of the antlers of the askanian deer hybrid and the fallow deer, and likewise (27, 30) the roe deer and the antlers of some hollow-horned animals.

Information on the study of the antlers of the reindeer (Rangifer tarandus) bears special interest in scientific terms. Descriptions are recorded of the skulls of the animals in the Far North found in excavations (64); a monument ("Kaaken") built of reindeer antlers on the shores of the Lesser Chaun Peninsula has been found (78).

In 1921 subsequent to the initial establishment of the first reindeer husbandry experimental station in Chukotka, S. V. Kertselli wrote: "Russia is the greatest and almost the only country of reindeer husbandry." At the present time the number of reindeer in the Russian Soviet Federated Socialist Republic is estimated to be more than two million. As distinguished from other animals, the antlers grow in both male and female reindeer. For this reason it is considered that they grow independently of the functions of the sex glands (37). Various investigators have given great taxonomic significance to the form of the antlers of the reindeer, and on the basis of this they erroneously constructed the entire systematics of the genus Rangifer (33, 68).

In the literature there are numerous references concerning the use of the calcified antlers of reindeer (11, 19, 42, 43, 47, 48, 52). Thus in the 1920's 20 to 40 tons of elk and deer antlers were transported from the regions of the Far North to the markets in England and other countries (59, 60, 90). Several authors (46, 67, 73) considered it expedient to cut the antlers and use them for the preparation of joiners glue in order to avoid trauma and "head sickness," and to increase the efficiency of fattening. In time research was conducted to study the technological properties of reindeer antlers and

the possibility of using them as a food medium (62, 75). The antlers are used for the elaboration of various artifacts (combs, mouth pieces, etc.). Antler shavings are used for preparing yellow blood salt (iron cyanide potassium) which can serve as a raw material for dyes (Prussian blue, Persian blue, and others) used in the production of colored paper and in typographic work, and for dying wool and preparing ink (66, 103).

With the development of science and the application of new methods of experimental research, the interest in the study of reindeer antlers has grown increasingly. In conjunction with the appearance of significant studies on the questions of the biology, physiology and anatomy of the reindeer, various information on the mineral composition of the antlers has appeared. Antlers are composed of up to 8.5 grams per 100 grams of aluminum, and likewise sodium, potassium, calcium and magnesium, sulfur, silica, phosphorus, chloride and iron (62, 75, 83). S. M. Druri has established that the growth of antlers and the shedding of the coat are indicators of the development of the reindeer and the intensity of the regenerative processes in the organism (33). As B. K. Bol' and L. D. Nikolaevsky established the histological picture of the growing antlers, undifferentiated chondroid tissues predominate from which the growth and formation of the bony mass may occur (4).

In Russian literature on reindeer husbandry from 1700 to 1931, including more than 2,000 sources, there is no information of any work devoted specifically to the study of reindeer antlers (72). In the publications of that time there are only brief references to the use of uncalcified antlers as food by the local inhabitants (20, 45, 58). Thus N. Popov writes: "the antler cartilage is so loved by the Tungus people that some gourmands decided to cut the horns from live reindeer." In one of the notes of the workers at the Magadan reindeer husbandry experimental station (now the supply office of the Magadan Zonal Scientific Research Institute of Agriculture of the Far East) is written: "at the time of the weekly migration, the food for us was only reindeer antlers, fresh flat cakes and tea with a little bit of sugar" (35). During work in the Kolyma and Chukotka area (1967 to 1969) one of the authors of the present work was repeatedly assured that the natives of these places (Chukchis, Lamuts, Yukagiris and others) often eat the tips of the growing antlers -- roasting them in the fire beforehand.

In national literature we were successful in finding some information on the medicinal use and pharmacological studies of reindeer antlers. In manuscripts of healers of the mid-17th century A. V. Prussak (60) informs us that the reindeer antlers are recommended for epilepsy, headaches, anemia; and the fat from them is used for curing ulcers and rheumatism. A veterinary pharmacological study of 1881 published in Russian (44) informs us that animal glue from the bones, antlers, hoofs, cartilage, etc. is a good nutritive substance during the recovery period "when there is a weakening of the digestive

organism after heavy bleeding (a faster formation of blood corpuscles)." In the same place it is indicated that "burned butter," Oleum cornus cervi, was obtained from reindeer antlers but because of the high expense, it was rarely used in veterinary practice.

A. C. Tevi (1936) studied the extract from antlers which were cut from reindeer in the Moscow zoo. In his conclusions he underlined the complete inactivity of the extract on seminal vesicles of castrated rats. G. I. Tsobkallo (87) used an alcohol extract from the antlers of five castrated reindeer bulls. Comparative research with the extract of antlers of other animals was not conducted. Through experiments on isolated organs (heart of a frog, ear of a rabbit, intestine of a cat) and in general experiments on a cat, a series of effects were established which led people to propose that choline was present in antlers and its derivatives have a choline-mimetic activity. During field work in the Anadyr region of the Chukotka National Area (June 1966) qualitative microcrystaloscopic reactions were carried out with samples of extracts from freshly cut, uncalcified antlers of mature reindeer bulls. Choline crystals were formed. In 1959 to 1961 in the Murmansk Reindeer Husbandry Experimental Station, medicinals ("MOOS-3") from the growing antlers of reindeer were prepared and tested. They were used successfully in reindeer husbandry and pig husbandry for increasing weight gains and increasing the resistance of the animal to severe illnesses (84).

Because we have not analyzed the above work critically, we consider it necessary to emphasize that it was not the basis for detailed research on pharmacological and experimental therapeutic characteristics in the creation of a new medicinal preparation from reindeer antlers. The proposal of using rantarin as a general tonalization medicinal medium prepared from the antlers of male reindeer was registered 7 June 1972 in the Government Register of Accomplishments of the Soviet Union (1). The authors of the accomplishment were I. I. Brekhman, I. F. Belikov, Y. I. Dobryakov, G. B. Ervandyan, N. V. Kozlov, N. V. Kuznetsov, N. I. Suprunov, A. I. Taneeva, A. M. Yudin and A. P. Yudin.

Rantarin -- Preparation from Uncalcified Antlers (Panty) of Male Reindeer

The initial investigation of the antlers was begun at the Collective Laboratory of Pharmacology and Experimental Therapy (I. I. Brekhman, major professor) of the Institute of Biologically Active Substances, Far East Division, Siberian Branch of the Academy of Sciences of the U.S.S.R. in agreement with the Magadan Regional

Director of Agriculture. The presence and character of the pharmacologically active extracts from reindeer antlers, their biological activities in various stages of development, and a clarification of the comparative characteristics of the pharmacological activity of the reindeer antlers and the axis deer antlers was established. The first stage of the investigation was initiated in 1964. The antlers (Fig. 1) were prepared in the Magadan Province.

Toxicity of the Preparation

The toxicity of rantarin (LD_{50} = 30.25 ml/kg) in experiments on laboratory animals was lower in comparison to pantocrin, a preparation from the antlers of the axis deer (LD_{50} = 14.5 ml/kg). A prolonged administration of the preparation (40 days) facilitated a faster growth and development of the antlers. Repeated experiments in which rantarin was used daily over the course of months testified to its harmlessness. In experimental and control animals the comparative weight of the organs (spleen, thymus, liver, heart, kidneys, ovaries and adrenals) was the same. Substantial changes in levels of general blood protein were not registered in the protein fraction.

The low toxicity of rantarin with single and prolonged dosage of laboratory animals testified to its harmlessness. The investigators, i.e. laboratory workers who took the preparation for a long period of time, themselves are likewise convinced of this fact.

Specific Effect

Various experiments were conducted by a group of researchers (I. I. Brekhman, Y. I. Dobryakov, O. I. Kirillov, P. P. Golikov, A. M. Yudin, B. N. Blokhin and G. D. Savichev) on laboratory animals and human volunteers in order to determine the pharmacological properties of rantarin. Various effects were discovered.

Gonadotrophic Effects. This effect is defined in gonadotrophic units of activity (GED_{33}) and is determined by the degree of sexual development of laboratory animals. It was established that extracts from the antlers of reindeer give rise to earlier sexual development of sexually immature male white mice. The maximum gonadotrophic activity of one gram of antlers of the male reindeer (439 GED_{33}) was almost the same as the activity of the highest quality antlers of axis deer (447 GED_{33}). The activity of the antlers depended upon the time of cutting.

The results of the investigation showed a complete correlation in the activity of reindeer antlers and axis deer antlers, both in terms of gonadotrophic activity and in terms of capacity to delay changes after castration.

Stimulation Activity. The length of time of dynamic activity of white mice was calculated on an endless belt. Activity was expressed in stimulation units of activity (SED_{33}). In this type of pharmacological effect the extract from the reindeer antlers was only about one half (67 SED_{33}) that of axis deer antlers (103-126 SED_{33}). However it was not inferior in this respect to preparations from eleutherococc, "false ginseng."

Research was conducted on healthy sportsmen of average qualifications. For this experiment their work capacity was defined in terms of static load-bearing (holding a weight at rest on a gymnastic bench) and dynamic activity (work on the velo ergometer). In terms of static load-bearing (holding a weight at rest) rantarin increased the time of work (over the control sportsmen) by 3.6 ± 3.2 sec. In contrast, pantocrin increased static load-bearing time by only 1.8 ± 2.1 sec. over the control sportsmen. In tests of dynamic work on the velo ergometer, sportsmen given rantarin gave an increase of 88 kg/m whereas those given pantocrin gave an increase of 59 kg/m over the control group. The "control" sportsmen, i.e. those not given rantarin or pantocrin, performed only 15 kg/m dynamic work.

In studies involving men (18 to 22 years of age) it was established that rantarin increases the qualitative characteristics of intellectual activity.

Anti-inflammatory Activity. Rantarin showed a marked anti-inflammatory activity in experiments on laboratory animals. Therefore it is acceptable for use in illnesses which are accompanied by inflammatory processes.

Anti-stress Activity. The preparation weakens undesirable effects (hypertrophy of the adrenals, involution of the thymus glands, hemorrhages in the mucous membranes of the stomach and decreased weight of the liver and kidneys) in its actions upon an organism under extreme stress.

Hypotensive Action. The lowering of blood pressure is a major property of pantocrin. The same effect is noted with the use of rantarin.

Thus the results of the experimental research testified to the medicinal effectiveness of rantarin in various pathological conditions of the organism.

Preparation of Antlers

Previously no one has studied questions concerning the preparation and processing of reindeer antlers. This is understandable in view of the fact that up to this time no one has suggested massive utilization of uncalcified antlers of reindeer as a medicinal raw material.

The antlers are prepared directly after they are cut from the animals. Usually this is done after driving the animals into a portable or stationary corral. It is possible to cut antlers directly from the herd that is on the tundra in a resting or pasture area. The number of special antler cutting stations are inadequate in northern reindeer husbandry areas. For this reason the reindeer are caught with the help of a "chaata" (a flexible, long lasso which is plaited from narrow strips of specially prepared reindeer hide). The reindeer are tied in a lying position on the ground. After this the base of the antler is disinfected and the antlers are cut.

The method described for cutting the antler seems at first glance archaic in comparison with the generally accepted practices of cutting antlers of the maral and axis deer. However in the tundra conditions of reindeer husbandry with a constantly nomadic herd of animals, this method has proved satisfactory. Nevertheless it seems necessary to develop special portable stations for cutting reindeer antlers which would correspond to the conditions of reindeer husbandry.

Five to seven men participate when cutting antlers. In a time study of their work it has been established that an average of seven minutes is spent in the capture of one reindeer and cutting of the antlers. However if only selected reindeer are to be captured, the time expended increases to approximately 16 minutes.

The cutting is done with a small-toothed sheet metal saw which is one of the veterinary implements for reindeer husbandry. The cut is made above the first, and sometimes above the second, branch over the eyes. These conditions should be followed strictly in order to avoid heavy blood loss from the remaining tines of the antler on the head of the reindeer. The cut is not usually bandaged. The blood vessels are "cleaned" with a knife by pressing on the tine for a short time and cutting its superficial layers. In order to avoid trauma if the trunk of the antler has a very large diameter or is extremely juicy, the antler is circumscribed lightly on the surface with a sharp knife and then sawed along the course of the cut. The antlers should be cut completely at once, avoiding breaks and while holding or supporting the antler with one hand.

The cut antlers, depending upon the age of the animal and the time of the cutting, have various weights and dimensions (Table 1).

TABLE 1. Characteristics of reindeer antlers.

Time of Cutting	Experiments	Antlers	Group of Reindeer	Length of Trunk* (cm)		Weight of Raw Antler (gm)	
				With skin cover	Without skin cover	With skin cover	Without skin cover
June 1	3	12	Castrated animals over 2 years of age	--	37.2±3.0	403±56	243±45
	4	12	Castrated animals over 2 years of age	37.5±3.1	36.2±2.9	443±65	257±38
	5	10	Male animals over 2 years of age	27.8±2.4	25.5±2.4	263±31	153±18
	6	10	Male animals over 2 years of age	26.7±2.2	25.4±1.7	236±29	136±16
June 10	7	6	1 year old males	16.2±2.8	14.2±1.9	109±22	58±12
	8	4	Male animals over 2 years of age	37.6±5.4	36.0±5.0	346±67	212±41
	9	10	2 year old steers	42.1±2.7	40.7±2.8	377±62	213±39

*Authors presumably mean the main antler beam ... Editors.

They are usually kept in the snow in order to maintain the skin cover. More frequently the antlers are preserved by one of the methods indicated below immediately after cutting.

Methods of Antler Preservation

Tibetan doctors preserved the whole antlers of the reindeer by air-drying them for two to three weeks, or by cutting the antlers into pieces and threading them on a string and again air-drying them. Cooking the antlers in water was not allowed. We use this method under the conditions of the continental climate of Mongolia and Tibet. In moist climates, however, another method is used; the antlers are cooked in a solution of cooking salt and then dried in the air (10, 55).

For a long period of time in our country the method of preserving antlers of the axis deer has been used. This consists of repeatedly immersing the antlers in hot water for several days and then drying them. This method has been simplified and has become part of the practice of antler cooking -- a method developed by P. N. Dobvin (50). The methods of preservation were perfected (12, 14, 15, 38, 91). At the present time the antler preservation experts of the Primorsky District dry the antlers with the help of an electric heater.

According to the opinion of several authors (49), during the process of preserving the antlers the level of peptides and amino acids is increased (70), and their biological activity is raised (74). It is necessary to create a new standard for antler production for the needs of the national pharmaceutical industry (6, 82, 102). The weight of correctly preserved antlers of the maral and axis deer does not alter during 11 months of storage (53).

In developing methods for preserving reindeer antlers, we had to be guided by the methods used in the axis deer antler husbandry practice. Subsequently it was realized that these methods are not applicable to the conditions of reindeer husbandry. Considering the specifics of work in the Far North, we developed technical facilities for preserving the antlers of male reindeer and several possible methods of preservation.

For antler preservation experiments the antlers are obtained from a herd near a stationary drying shed or preserved directly in the wind or in a tarpaulin shed at the nomadic camp of the worker brigade. One of the methods of preparing the antlers is heat-drying in a stationary facility. One specific experiment was conducted in 1965 at the

collective farm of "Omolon" in the Magadan Province. Those who participated were: the honored veterinarian of the Russian Soviet Federated Socialist Republic, N. V. Kozlov; veterinarians A. P. Yudin and V. Polyshenko; veterinary assistant V. I. Matveev; antler expert L. P. Dovbnya; and research assistants A. M. Yudin and Y. I. Dobryakov. Later other methods of preservation were also developed. The work occurred in 1966 in the forest tundra zone of Chukotka (Anadyr Region). The assistant of the Magadan Reindeer Husbandry Experimental Station, A. I. Trenev, participated. All the research occurred directly on the tundra during a rest stop of the nomadic reindeer husbandry brigade.

Preservation of Antlers in Stationary Conditions

The antlers are dried at high temperatures. (Research conducted has given us the basis for excluding one of the traditional steps of preservation, i.e. boiling the antlers.) The method of preserving the antlers with the skin cover is described below. They are placed for four to six days in a drying chamber where the temperature is maintained at a constant 50 to 90°C.

The Drying Chamber (Fig. 2). This is composed of a wooden frame placed on a 10 cm layer of gravel and pebbles upon which is placed the fire chamber which is made of two tubes of open-ended iron pipe. Each of the tubes consists of three standard pipes with a capacity of 200 l and placed end to end. A common smoke pipe from the tubes extends. The exterior of the drying chamber is protected with boards and tar paper. Inside there are two sections with shelf frames for the antlers. The frames are rectangular with a kapron net. Above the chamber are openings for ventilation; on the sides there are small doors.

The high heat capacity of the pebble hearth allows a lengthy (four hours or more) drying period and a relatively constant temperature (70 to 90°C). The capacious pipes allow firewood to be burned without sawing or splitting it in advance.

In spite of the apparent primitiveness the chamber is practical and appropriate for use in preserving antlers. At the present time the use of electric heaters in reindeer antler preservation has not been studied. The use of the chamber described above has its advantages, namely:

(1) low expense of equipment and simplicity of construction;
(2) high heat capacity of the pebble hearth;
(3) the use of firewood (any dimension) as fuel; and
(4) economy of electricity.

Preservation of Antlers in Tundra Conditions

In the forest tundra and the polar tundra, antlers are preserved without the superficial skin cover although the underskin is maintained. Boiling does not occur.

Heat Drying

The preservation takes place in a common tarpaulin tent. A tent measuring 135 cm wide by 200 cm long by 225 cm high is used. A temporary stove of sheet metal is placed inside. The dimensions of the stove are 40 cm wide by 78 cm long by 30 cm high. Stoves (31 x 42 x 22 cm) are used. The stove pipe is 150 cm in length. A net for the antlers is fastened to the tent and placed above the stove. In order to prevent the net from sagging a spreader for the net is made of dry branches of birch. Dry cedar or birch are used for firewood.

In equipping the tent it is necessary to observe the following anti-fire measures. The exit of the stove pipe through the tent is protected with sheets of asbestos or sheet metal. The exterior portion of the pipe (at least 70 cm in length) should end with a 60 cm long L-shaped elbow with the end down which turns in the strong wind. The tarpaulin floor of the tent is cut back in an area somewhat larger than the area of the stove which is placed on a layer of gravel or rocks.

To maintain the necessary temperature within the tent, the entrance (hole) should be made in the form of a sleeve. A layer of pebbles (gravel, small rocks) is placed on top of the stove. These pebbles help maintain a relatively constant temperature.

Preservation. The stove is loaded with firewood every two to three hours, and the temperature in the shed is kept below 60°C.

The antlers are placed on the net which is hung over the stove. The termination of the preservation is defined by the "dry" sound of the antlers when they are hit against each other. In order to protect against extremely high temperatures, one may use pieces of common paper which darkens at high temperatures. Usually this is not necessary since it is recommended that the temperatures do not become so hot that the tent is in danger of burning.

In view of the constant nomadic migrations of the reindeer herd preservation frequently has to be interrupted. The antlers may be kept in a box for 10 to 15 hours, and then put again into the chamber (tent) to finish drying. Sometimes it is necessary to increase the length of time of drying because of the slow drying of the cartilaginous tips of the antlers.

The length of time for preservation by this method is not more than 24 hours (averaging 15 to 16 hours).

Wind (Air) Drying

The method indicated above for preserving antlers is most successful under the conditions of the taiga and forest tundra where there is fuel (firewood). In the polar tundra the only type of drying possible is wind (air) drying. It does not present any difficulties because the surrounding air on the tundra is unpolluted. The method is successful because of the lack of sharp variations in temperature and the intense solar radiation, i.e. sunshine, from May to June when antlers are usually cut. It is more expedient to preserve antlers using this method in the river valleys because there are fewer storms there than on the hillsides. The antlers without skin cover which are hung on the lines near the tent ("yarang") dry within 10 days during inclement or rainy weather. In sunny weather this time is decreased by half. When cut, these antlers have a rosy color.

It is not possible to dry antlers with skin cover intact when using the wind-drying method; after 12 days the only thing that takes place is some autolysis of the cartilaginous tips and of the blood of these antlers.

Under field conditions when using the two previously described methods of preservation the yield of the prepared product is usually the same (Table 2).

General Principles of Antler Preservation

The preservation of reindeer antlers occurs in May through July under the conditions of the Magadan Province. After they are cut, the skin cover is removed although the underskin is retained. The antlers are not cooked in hot water. The cartilaginous tips should be hard once the preservation process is finished; the appearance of elasticity when they are hit shows that they are not sufficiently dried. The completion of the drying of the antlers is defined by the "dry" sound when they are hit against each other. Preservation takes place in one of the following manners.

1. Preservation in stationary chambers. Following are the principles for the construction of the simplest drying chamber. Open-ended iron pipes are placed on the foundation to serve as a stove. Above this is placed the frame of the chamber covered with boards and

TABLE 2. Average percent of drying of male reindeer antlers by various means of preservation in field conditions.

Method of drying	No. of antler pieces	Percent of drying of antlers with skin cover		Yield of prepared product, %
		In comparison to weight of raw antler with skin	In comparison to weight of raw antler without skin	
Heat drying	1	78.5	63.0	37.0
	2	82.0	68.0	32.0
	3	81.0	69.3	30.7
Wind drying	4	78.3	63.0	37.0

tar paper. Inside are shelf frames for antlers. The floor of the chamber is a layer of stones. To complete the preservation, antlers are placed on the shelf frames in the chamber for 38 to 48 hours.

2. Preservation by heat drying in field conditions. A tarpaulin tent with a temporary stove is used. The antlers are placed above the stove. The time of preservation does not exceed 24 hours.

3. Wind drying in tundra conditions. The antlers, with the skin cover removed, are hung up in the air. The duration of drying depends on the atmospheric conditions and can last from five to 10 days. In a cross section they have a rose color.

Conclusions

In our surveys on reindeer husbandry (94, 95, 99) we noted the great significance of specialized reindeer herds. In regard to mass antler preparation, it is necessary, in our opinion, to give a new direction to reindeer husbandry; that is, the creation of herds that are structured to produce medicinal raw materials. Because of this, new problems arise for the practitioners and scholars: the definition of the optimum herd structure having a prevalence of males, the major source of antlers; continuation of the study of the antlers of females and developing methods for determining false antler production; a precise determination of the dates for mass cutting of the reindeer antlers in the various zones of the North; and the creation of special equipment for holding the reindeer and cutting the antlers, taking into consideration the practice of reindeer husbandry and using the simplest equipment (92) in work with reindeer. It is necessary to study in detail the influence of mass cutting of antlers on the general productivity of the reindeer herd, and to develop new qualitative tests for evaluating the produce and methods for stimulating the growth of the antler and achieving a "second harvest" of antlers in one season. The development of specialized transport, e.g. "air sleighs" (93) for more rapid transport of the cut antlers to the place of further preparation will be of great significance.

It is known that preservation of bone for surgical transplant by means of rapid cooling of the material and storage at minus temperatures supresses autolysis (3). The preservation of the parenchyma of organs at low temperatures changes the immunological processes (16, 63). In connection with this the solution to the problem of the expediency of keeping cut antlers at low temperatures acquires not only a theoretical but also a deeply practical interest. Far Eastern research should be directed to this issue (15).

In considering the general problem of further raising the profits of reindeer husbandry, the question of the expediency of using secondary raw materials arises. Thus, according to the information of S. M. Druri (34), only the reindeer husbandry enterprises in the European north obtain more than 150 kg of rennet powder for use as a fermentation raw material from reindeer husbandry. The fibers of the tendons according to S. A. Gryunera are an optimum material for tying blood vessels; their value for surgery has been noted by many authors (18, 56).

According to the data of K. V. Rodonova (61), the yield of blood from the adult reindeer is about 3.5 to 8.0 l or no less than 10% in terms of the weight of the body when the animals are slaughtered vertically. The figures for the volume of blood of the reindeer are comparable to alpine animals (17). The blood differs from that of other domestic animals in physical properties and chemical composition, but it is possible to use the blood to prepare medicinals and veterinary drugs as a kind of hematogen and pantohematogen (96-98, 100, 101). In the process of obtaining and using the antlers it is appropriate to pay special attention to the question of preserving the blood. The role of the blood in the antlers of reindeer is not clear.

Natural raw materials (hypohysis, adrenals, ovaries, etc.) do not loose their significance in the present age of synthetic preparations. Calculations show that in the Far Northeast there are sufficiant raw materials for obtaining a variety of medicinals from secondary products of reindeer husbandry (Table 3). Those who believe more attention should be devoted to the development of various types of reindeer husbandry (51) as a source for medicinal and food products are completely correct.

TABLE 3. Some types of secondary produce of reindeer husbandry of the Magadan District (on the basis of calculation taken from results of research of various years by K. V. Rodionova, S. M. Druri, A. F. Mirovicha and A. M. Yudin).

Northern zone	Given to government, sold or given as extra pay in 1968 according to the data of the Magadan Province Statistics Dept.		Supposed (theoretical) supplementary produce							
	Reindeer (head)	Meat (centners)*	Blood (l)	Hypophysis (kg)	Adrenals (kg)	Thyroid glands	Ovaries (kg)	Antlers (tons)	Stomach (kg)	Intestines (1,000 m)
Magadan Province	174,244	138,059	871,220	87.1	261.4	1045.5	522.7	348.5	104,545.4	4730.7
Chukotskii National Region	143,960	114,127	719,800	72.0	215.9	836.8	431.9	287.9	86,376.0	4111.9

*1 centner (U.S.S.R.) = 100 kg.

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